UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Health and Safety
District C

Welch, West Virginia
September 14, 1959

Memorandum

To: Mr. W. R. Park, District Supervisor, District C

From: J. T. Whalen, Federal Coal-Mine Inspector, and J. L. Gilley, Mining Health and Safety Engineer

Subject: Report on Investigation of Minor Coal-Mine Bump, No. 9 mine, Jewell Eagle Coal Company, Melville, Logan County, West Virginia, August 18, 1959

A coal-mine bump in the 1 butt left pillar section of the subject mine at 11:00 p.m., Tuesday, August 18, 1959, resulted in minor injuries to Charles Young, cutting-machine operator's helper, and Paul Noe, shot firer. After receiving first-aid treatment, Young and Noe were taken to a hospital in Logan, West Virginia, for further treatment and observation. Ulysses Justice, the cutting-machine operator who was working with Young after completing his regular 8-hour shift plus 45 minutes overtime, at the suggestion of an official, went to the same hospital for examination. Justice was released immediately after the examination revealed he did not sustain any injuries. Young received multiple contusions of the scalp and pain in the lumbar region and Noe received minor contusions of the scalp. Young was released from the hospital on August 24 and Noe on August 21.

The Logan field office of the Bureau of Mines was notified about the occurrence of the bump at 8:00 a.m., August 19, 1959, and an investigation was started that day and completed the following day. The investigation was made by the authors accompanied by various company officials, including W. S. Robertson, company safety inspector.

The No. 9 mine was opened by 2 slopes, one 840 feet in length and the other 1,080 feet in length, and is operated in the Eagle coal bed, which ranges from 42 to 60 inches in thickness, locally. A total of 162 men was employed, 37 on the surface and 125 underground, on 2 shifts a day, 3 to 5 days a week. The average daily production was 1,800 tons of coal, all loaded by 14 BU Joy loading machines into shuttle cars. This coal property is in the basin of Coalburg syncline and dips toward the basin about 3 percent northwest and out of the basin at a greater degree of inclination. The mine is gassy.

Copy to: James Westfield (2)
Charles Ferguson (2)
Ed Thomas
J. T. Whalen
J. L. Gilley (4)
W. S. Robertson
Files

The last Federal inspection was completed August 11, 1959.

Localized dispositional changes in the immediate and in the main roof structure occur in many parts of the mine. In some areas, the coal is overlain by gray sandstone ranging from 15 to 60 feet in thickness; in other areas, the immediate roof consists of thinly bedded gray shales 12 to 30 inches in thickness overlain by beds of shaley sandstone and/or sandy shales ranging up to 15 feet thick. Logs of drill holes on an adjoining mining property indicate several sandstone beds ranging from 30 to 166.5 feet in thickness. Bed separation usually takes place at various horizons (depending upon the structure) above the coal bed following mining; this displacement with successive bending of overlying members likely results in a load equal to part of their weight being exerted on the coal in the working areas. Sloughing or squeezing of the coal along the ribs has been observed in the development as well as in the abutment zones of the pillar workings.

The mine floor is predominately hard, dense shale or siltstone, and very little heaving was in evidence in the 1 butt left section. Heaving of the floor has been observed in other parts of the mine on previous visits over a 10-year period.

The mine is developed by a multiple entry system, and pillar extraction is by a room-and-pillar system. The main entries, at present, are developed in groups of 6, but in the past were developed in groups of 4, 6, and 10. Butt entries are developed at various intervals in groups of 6, and room entries in groups of 6 (but in the past in groups of 3, 4, and 6) at intervals of about 200 feet. Entries are projected to be driven 20 feet wide on 60-foot centers and rooms 20 to 24 feet in width on 60-foot centers. Entry crosscuts are on 80-foot centers, and room crosscuts on 60- and 80-foot centers.

Pillars are extracted by an open-end pocket system. Normally, pillaring is started as soon as a group of entries, such as the 1 butt left entries, has advanced the predetermined distance and rooms 1 to 5 at the top end of the panel completed by driving them abreast their projected distance of 200 feet or until they hole through into previously mined-out areas.

The system of development and extraction utilized in 1 butt left is shown in Sketch 2. The 1 butt left entry pillars were about 40 feet in width and 60 feet in length. The rooms involved were driven 20 to 32 feet in width, thus making the blocks (pillars) 28 to 40 feet in width and about 40 to 60 feet in length. The individual pillars are extracted by taking successive open-end lifts, 20 to 25 feet in width, across the back side of the pillars from the entry side of the entry chain pillars and from the room side of the room pillars; however, in some instances, the last lift (usually a push-out) is completed from the crosscut side of the pillars. After completion of the pillars in a panel of 5 rooms,

the entry-chain pillars are extracted to a point opposite the No. 5 room then another panel of 5 rooms is developed, as illustrated in Sketch 2. This system eventually establishes approximately a flat extraction line, but in the process development of rooms such as in the 1 butt left section is toward the gob in an abutment zone, and in some instances probably superimposed from 2 mined-out areas. (Old gob area from 2 butt left and the recently mined-out inby panel of rooms.)

The methods of roof support in the 1 butt left entries and rooms comprised roof-bolting and conventional timbering. Four 5/8-inch diameter expansion-type bolts, 42 inches in length, were installed vertically in rows on 4-foot centers longitudinally and transversely in the rooms and in the entries. Four or more bolts were installed close to the rib lines before crosscuts were turned. Bearing plates were of the embossed type, 6- by 6- by 1/4-inch in dimensions. The roof bolts were supplemented by a row of posts set with cap pieces and wedges on about 4-foot centers along each side of the roadways. The roof in pillar lifts was supported with 1 or more rows of posts set along each side of the roadways. Safety posts were required at the faces during the various mining cycles. Rows of breaker and turn timbers were set promptly before turning the pillar lifts. An excellent job of supporting the roof by prompt application and compliance was evident in the 1 butt left section.

Development and extraction of the coal in the 2 butt left territory was completed during the period of November 1956 to October 1958; however, the specific location of the 2 butt left mined-out area into which the rooms of 1 butt left (those involved in the bump) holed through, was completed during September 1958 or about a year previously. Reportedly, several remnants of pillars were left unmined in 2 butt left, and from Sketch 2 it will be noted that 1 complete chain pillar and remnants of other pillars were left unmined inby in the recently mined-out area of 1 butt left. This unmined coal in 1 butt left, reportedly, was abandoned because of adverse natural conditions and developments that further complicated conditions during the idle 2-week holiday (July) period. Nevertheless, at the time of investigation, caving of the roof apparently with depth extended to the limit of extraction, as indicated in Sketch 2. The evening-shift foreman informed the writers that a comparatively large roof fall occurred in the mined-out area flanking the active No. 1 room during his shift on August 17.

On the afternoon of August 18, the second-shift crew, comprising 13 men, including the foreman, arrived on the 1 butt left section at 4:20 p.m., and, according to the reports of the officials interrogated, conditions were normal. The evening-shift section foreman stated that 12 cuts or about 375 tons of coal, had been loaded prior to the bump and that the loading machine was being trammed into the No. 5 room after cleaning up the coal in No. 1 room.

Location of the faces of the 5 rooms and the location of the men and equipment at the time of the bump are indicated in Sketch 1. It will

be noted that the No. 1 room lacked 22 feet being completed, the No. 2 room had holed through, and an open-end lift had been advanced to a depth of 20 feet into the pillar between Nos. 1 and 2 rooms. The No. 3 room had holed through into the gob and the last cut of coal at the face of No. 4 room had been cut and blasted. The No. 5 room had holed through and the first cut in the pillar lift to the left had been cut and blasted. Three of the rooms, Nos. 3, 4, and 5, had cut or holed through during the evening shift. The only men performing work at or near the working faces at the time of the bump were 2 timber men setting timbers near the entrance to the pillar lift in No. 2 room and the cutting-machine crew and shot firer in No. 3 room.

At the time of the bump, the cutting-machine crew was putting in the first cut (undercutting) preparatory to starting an open-end lift in the inby pillar to the right in the No. 3 room. Inasmuch as an open-end pillar lift was also to be driven (according to plan) across the back side of the inby pillar on the left side of No. 3 room, decision to start and drive the pillar lift on the right side simultaneously was admittedly a matter of expediency and contrary to the company's pillaring plan. Under ordinary conditions, however, merely putting in a cut on the back side of a pillar would have little or no effect from a bump aspect other than to expose more roof.

At the time the bump occurred, the cutting machine was the only equipment being operated at the faces; the cut of coal in No. 4 room had been blasted about 10 or 15 minutes previously. The cutting machine had undercut the coal for a distance of about 4 feet (from the point of sumping toward the open end or gob side of the pillar) when the outburst occurred. Effects of the outburst or bump were evident in each of the 5 rooms, but the intensity or violence was least pronounced in the No. 5 room. The greatest forces, however, were released in the area comprising the last inby pillars of Nos. 1, 2, 3, and 4 rooms, as indicated by the greater amounts of coal thrown outward from these pillars, a few broken timbers in Nos. 1, 2, and 3 rooms, and by the fact that the roof was affected only in the confines of that area (particularly along the right rib in No. 1 room, along the inby rib line of the crosscut between Nos. 1 and 2 rooms and at 1 location in the respective roadway of Nos. 2 and 3 rooms). A dense cloud of dust was thrown into suspension, but methane, according to the section foreman, was not released by the bump. The stress wave was rather intense, and, reportedly, the tremor was perceived by persons on the surface within a radius of a mile from the scene.

The 2 workmen evidently were injured by flying coal. The loading-machine operator's helper who was nearest the coal rib was partly covered by the outrush of fine coal but was quickly released by other workmen. The height of the coal in the No. 3 room was 42 inches, which required the workmen to perform most of their work on their knees. Approximately 10 tons of coal were thrown from along ribs of the 2 pillars in the vicinity

of the cutting machine. The foreman stated that 4 shuttle cars of coal were loaded from in front of and from around the cutting machine to permit it to be trammed from the scene and that about 25 mine cars of coal (about 75 tons) were loaded in cleaning up the roadways in the affected area. The only damage to equipment consisted of a "jammed" cutter-chain sprocket on the cutting machine.

The natural conditions, the mining methods and practices are primary factors to be considered in coal-mine bumps, and this occurrence is no exception. Circumstances under which this coal-mine bump occurred are evidence that a combination of natural conditions favorable for such occurrences existed in certain areas in this mine. Obviously, this combination in conjunction with other factors such as mining methods and practices that tend to accentuate rather than minimize overstressing or the impingement of forces in active pillar areas is most likely to cause bumps or outbursts with varying degrees of violence.

Maximum cover over the coal at this property is about 1,500 feet, the topography is rugged with some of the higher mountains exceeding 900 feet in relief. The immediate area being mined was overlain with thickly bedded sandstone overlain by several beds of massive sandstone. It was further determined that the mine floor in the area involved was a hard, dense, sandy shale that resisted heaving. These salient factors undoubtedly had subjected certain portions of the large block being developed, particularly along the back side (gob side) to fairly high stresses that extended for considerable distance within the block. From sketch 1 it will be noted that 5 rooms varying in width from 20 to 32 feet were driven on 60-foot centers into the large block in the manner and direction indicated; furthermore, this development was being done toward on old gob area within the front abutment or into an area more likely to be highly stressed by superimposed abutment loading from the gob areas of 1 butt left and 2 butt left, respectively.

From Sketch 1 it will be further noted that pillar recovery had started in Nos. 2, 3, and 5 rooms although the No. 1 room which was in the most critical area lacked 22 feet or more being completed at the time the bump occurred, consequently, the extraction of some of the pillars was started out of proper sequence. From Sketch 2 it will be noted that coal pillars and remnants of pillars of various dimensions were left unmined inby the active working area, and, reportedly, coal pillars of varying dimensions were left unmined in the 2 butt left gob area. These unmined pillars and pillar remnants probably delayed and/or prevented the massive roof from caving as it should, thus likely imposing additional stress on the newly developed room pillars in the area involved.

Reportedly, light bumps, which did not affect the faces to the extent that coal was thrown outward, occurred frequently during development of this and the preceding panel of rooms in 1 butt left. However,

it was learned during this investigation that a bump occurred while the loading machine was operating at the face of the No. 1 room with sufficient force to throw 3 or 4 tons of coal from the adjacent ribs. After this bump, the loading-machine operator trammed the machine back to the last inby open crosscut in No. 1 room and waited until the section foreman examined the place. The foreman stated that he did not discover anything unusual and instructed the loading-machine operator to load the loose coal thrown out into the roadway and finish loading the coal in the face. After the place was cleaned up, the loading machine was trammed into No. 5 room and had reached the location indicated in Sketch 1 when the bump occurred that injured the 2 workmen working in No. 3 room.

From all indications, this coal-mine bump was the result of the imposition of a shock load onto the pillars indicated in Sketch 1, particularly the inby pillars of Nos. 1, 2, 3, and 4 rooms flanked by the old gob of 2 butt left. The bump could have been triggered by stresses from percussion created by the cutting machine penetrating the coal of a comparatively highly stressed pillar. According to information from local officials, bumps of such intensity have not occurred previously at this mine; however, several outbursts, some resulting in fatalities, have occurred in a mine operating in the same coal bed on an adjoining property.

It is the opinion of the authors that this minor coal-mine bump accident was the resultant of an accumulative process from a combination of the above-mentioned factors, and the recommendations made during this investigation include:

1. A system of mining should be adopted that will produce the least number of critical areas during retreat mining. Critical areas are produced by pillar line points, pillars not developed sufficiently in advance, improper sequence in development and extraction.

2. Under no circumstances, where the natural conditions are conducive to or favorable for outbursts, should groups of rooms (such as those involved) be driven or developed abreast into stressed areas of coal pillars (abutment pressure zone) toward the gob.

3. The mining system should require that coal pillars be developed as nearly uniform in shape and size as practicable.

4. Complete extraction should be striven for and pillar remnants should not be left. If it is not possible to recover such pillar remnants, their load-carrying capacity should be destroyed.

5. Pillars should be recovered in a straight line. Irregular pillar lines result in excessive pressures on the pillar line points. (Those jutting into the gobs.) Experience has shown, however, that the lead end (top end) of a pillar line can be kept slightly in advance.

6. Widths of roadways in rooms and entries, including crosscut openings, should be kept to the minimum required by the approved mining plan (entries - 20 feet, rooms - 20 to 24 feet). The adopted mining plans and practices should be complied with at all times.

The authors gratefully acknowledge the courtesy and cooperation of the employees and mine officials.

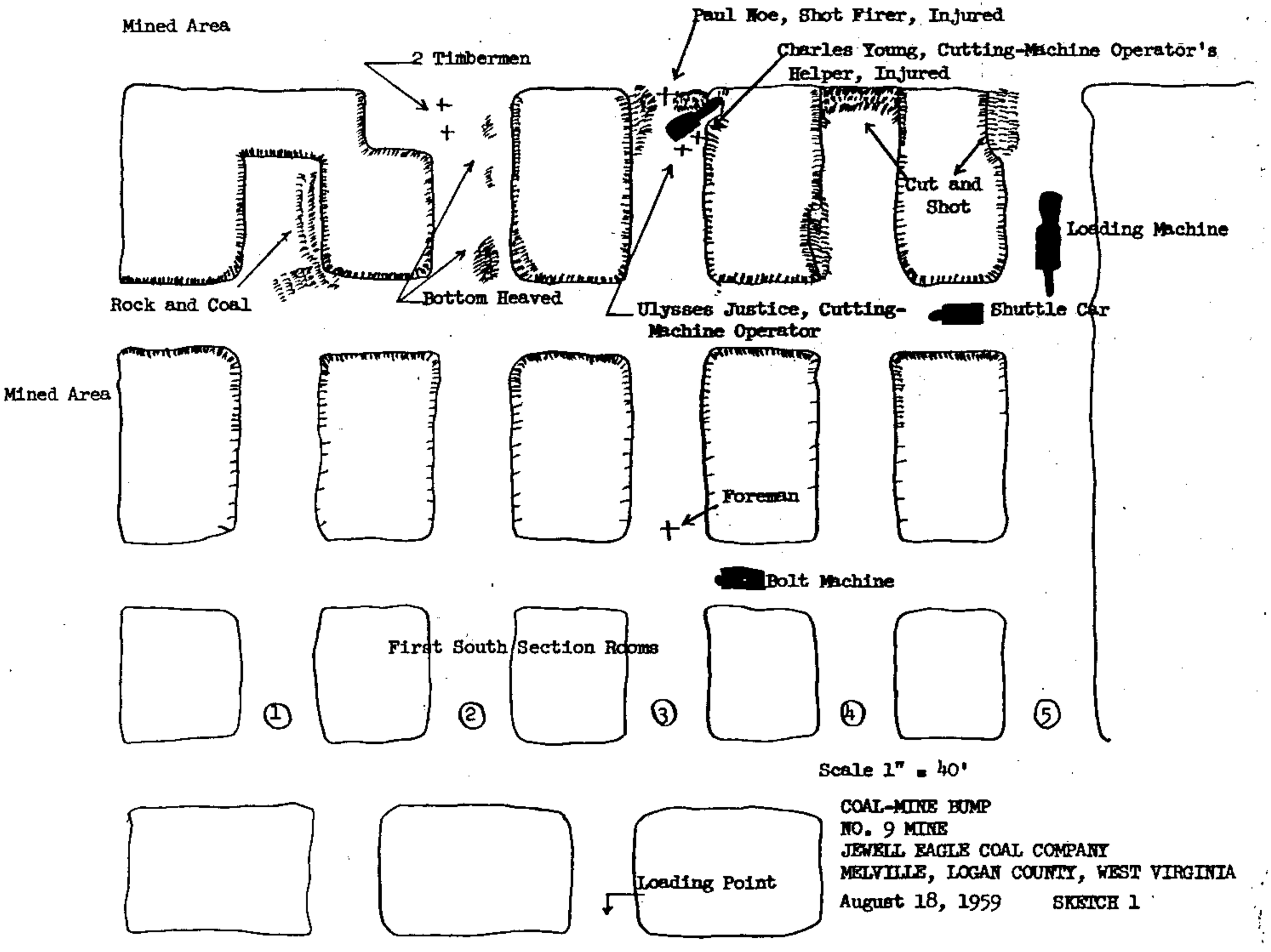
Respectfully submitted,

/s/ J. T. Whalen

J. T. Whalen
Federal Coal-Mine Inspector

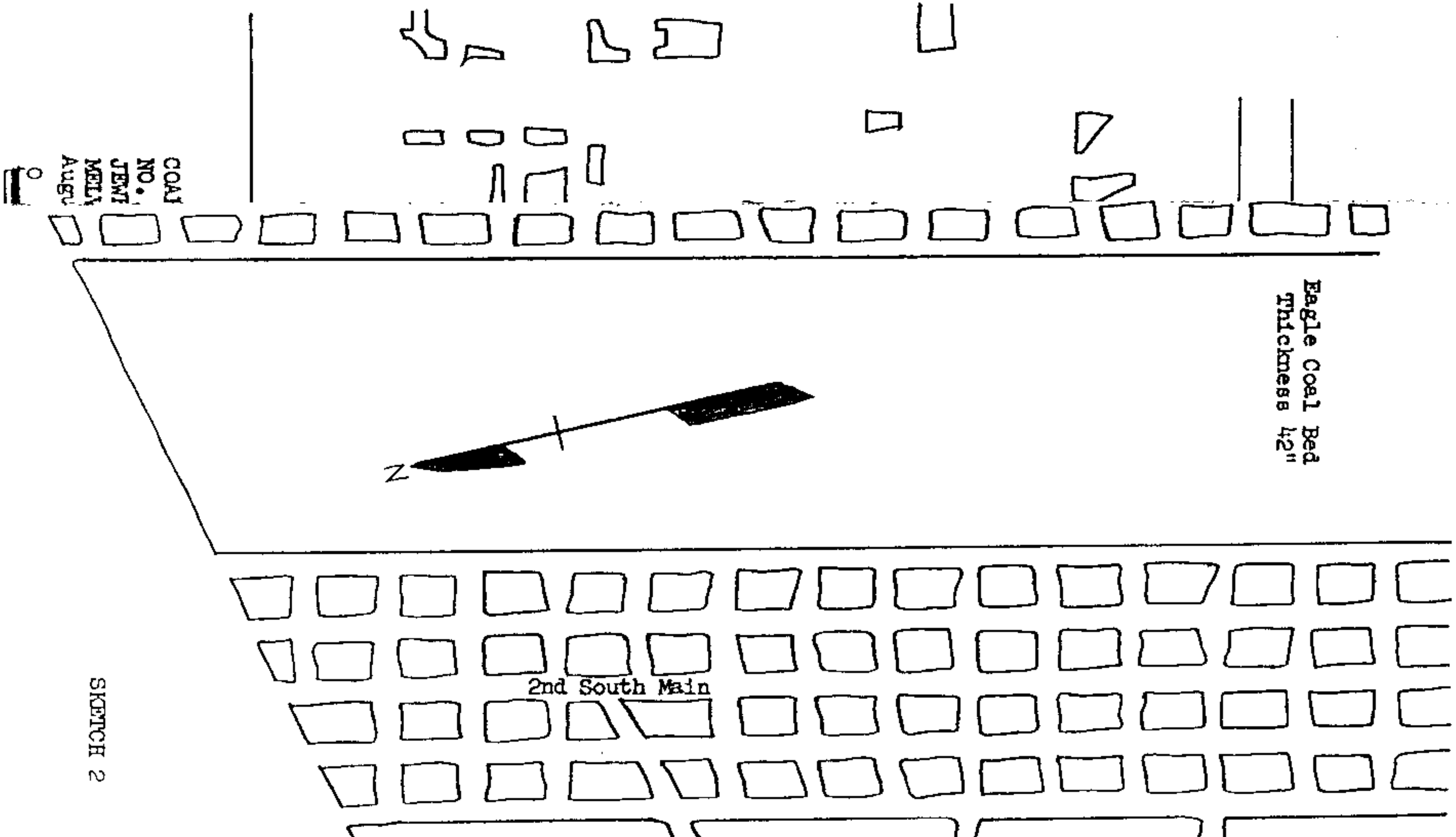
/s/ J. L. Gilley

J. L. Gilley
Mining Health and Safety Engineer

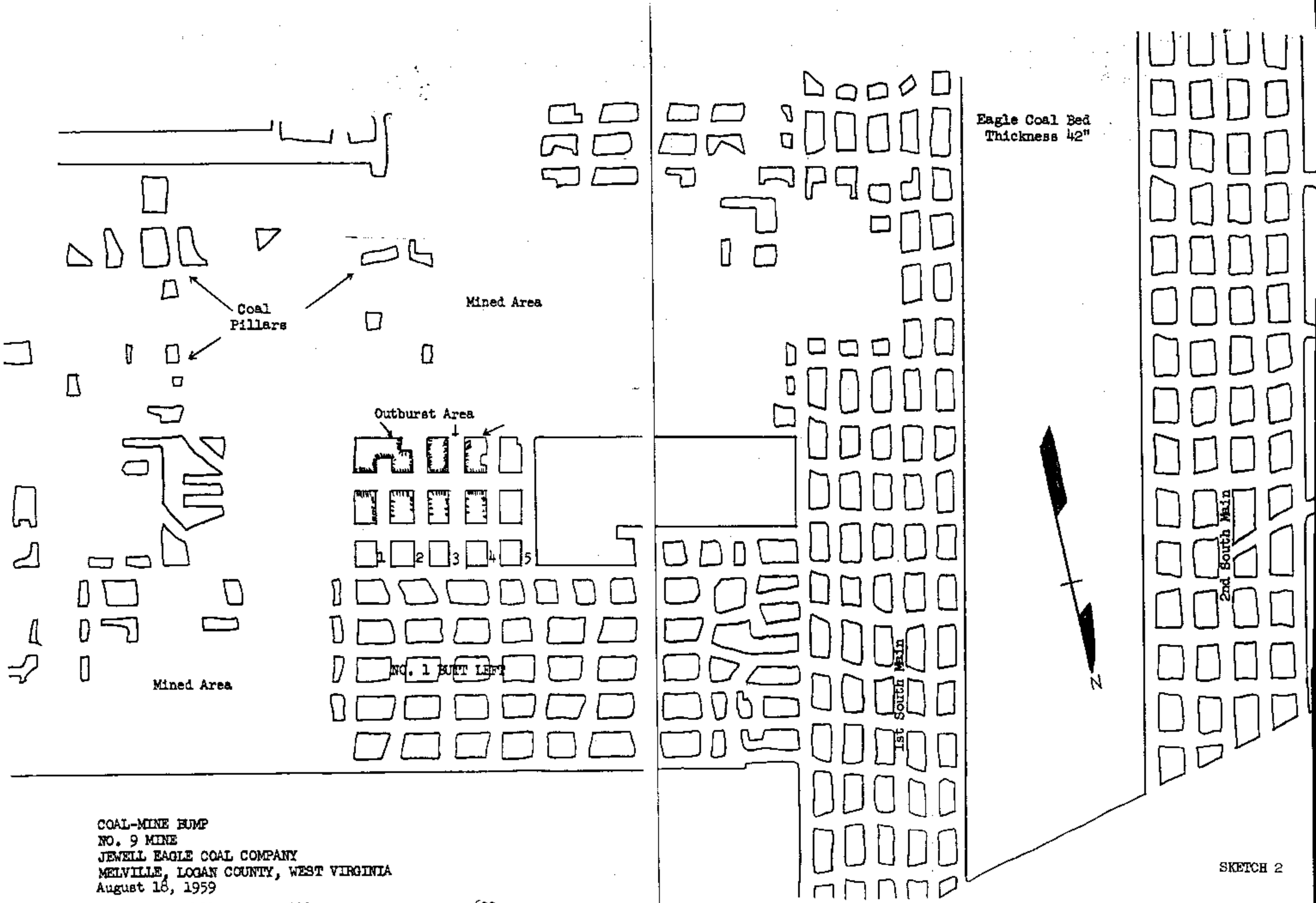


Scale 1" = 40'

COAL-MINE BUMP
NO. 9 MINE
JEWELL EAGLE COAL COMPANY
MELVILLE, LOGAN COUNTY, WEST VIRGINIA
August 18, 1959 SKETCH 1


COAL
NO.
JEWI
MEDI
Augu
Eagle Coal Bed
Thickness 42"
N
2nd South Main

SKETCH 2



COAL-MINE BUMP
NO. 9 MINE
JEWELL EAGLE COAL COMPANY
MELVILLE, LOGAN COUNTY, WEST VIRGINIA
August 18, 1959

0 150 300 600
Scale - Feet

SKETCH 2